

DS01-036

January 15, 2002

To: Commissioner of Patents and Trademarks
Washington, D.C. 20231

Fr: George O. Saile, Reg. No. 19,572
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Poughkeepsie, N.Y. 12603

Subject: New Patent Application (attached)
Inventor:
Title: CHARGE/DISCHARGE PROTECTION CIRCUIT FOR A
RECHARGEABLE BATTERY

PRELIMINARY AMENDMENT

Please amend the above-identified application (attached) for
patent as follows:

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited
with the United States Postal Service as first class mail in an
envelope addressed to: Commissioner of Patent and Trademarks,
Washington, D.C. 20231, on January 24, 2002.

Stephen B. Ackerman, Reg. No. 37,761

Signature



Date



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In the specification:

Please replace the paragraph beginning at page 5, line 5, with the following rewritten three paragraphs:

-- In one preferred embodiment of the present invention a resistive means coupled between load current switch 3 and charge/discharge terminal 6, shown in Fig. 1 as resistor 4, acts as a current sensor to determine the magnitude of the charge or discharge current. In another preferred embodiment of the present invention the transmission resistance of the load-current switch 3 may be utilized as the current sensing resistance.

Comparators D1, D2 of the control logic 10 are arranged to recognize a battery-side over- or under-voltage, respectively, and the comparator output signals trigger the opening of load switch 3 in the event of an over- or under-voltage.

With the exception of capacitors, at least all circuit elements of low power losses are integrated on one chip. In addition, but again excluding capacitors, all parts of the circuit can be integrated on the chip, including the load switch 3, the short-circuit switch 20, and the fusible link 2.--

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In the claims:

Please cancel claims 1 to 13.

Please add claims 14 to 28 as follows:

14. A charge/discharge protection circuit for a rechargeable battery, comprising:

a short-circuit switch coupled in series with a fusible link across the terminals of a rechargeable battery, where one end of said fusible link is connected to one of said battery terminals, where said short-circuit switch when closed leads to the guaranteed destruction of said fusible link, thereby protecting said rechargeable battery from a dangerous current over-charge;

one end of a load current switch coupled to the junction of said fusible link and said short-circuit switch, the other end of said load current switch in communication with a first charge/discharge terminal of said protection circuit, said load current switch connecting or disconnecting said first charge/discharge terminal from said rechargeable battery;

a second charge/discharge terminal of said protection circuit coupled to the other end of said battery terminal; and

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a control logic, coupled between said battery terminals and in communication with said first charge/discharge terminal, said control logic protecting said battery and said first and said second charge/discharge terminal from over-/under-voltage conditions, where said control logic opens or closes said load current switch depending on the magnitude of the battery voltage and the potential at said first and said second charge/discharge terminal of said protection circuit, said control logic comprising an over-voltage detector which closes said short-circuit switch when reaching a predetermined voltage limit, where said predetermined voltage limit depends on the electric strength of said protection circuit.

15. The protection circuit according to claim 14, wherein said over-voltage detector receives as supply voltage the potential via the opened load-current switch.
16. The protection circuit according to claim 15, wherein said over-voltage detector receives as supply voltage the difference between the potential at said first and said second charge/discharge terminal and the potential at said battery terminals.
17. The protection circuit according to claim 16, wherein, when said predetermined voltage limit is exceeded, said control logic closes the previously open load-current switch followed by the time-delayed closing of said short-circuit switch.

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18. The protection circuit according to claim 17, wherein said control logic receives a first supply voltage from said battery and a second supply voltage from an auxiliary voltage source, such as a charged buffer capacitor.
19. The protection circuit according to claim 14, wherein said over-voltage detector comprises a bistable flip-flop.
20. The protection circuit according to claim 19, wherein an output signal of said bistable flip-flop feeds a delay-element, said delay-element providing the control signal for the closing of said short-circuit switch.
21. The protection circuit according to claim 20, wherein said output signal of said bistable flip-flop via an inverter couples to the first input of an AND gate, where the output signal of said AND gate controls said load-current switch.
22. The protection circuit according to claim 14, wherein a resistive means in communication with said other end of said current-load switch and said first charge/discharge terminal acts as a current sensor to determine the magnitude of the charge or discharge current.
23. The protection circuit according to claim 14, wherein the transmission resistance of the said load-current switch is used as a current sensing resistance.

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24. The protection circuit according to claim 14, wherein said control logic has a first and a second comparator (D1, D2), to recognize a battery-side over-/under-voltage, respectively.
25. The protection circuit according to claim 24, wherein an output signal from each of said first and said second comparator triggers the opening of said load switch in the event of an over-/under-voltage, respectively.
26. The protection circuit according to claim 14, wherein a filter capacitor is coupled parallel to said charge/discharge terminals.
27. The protection circuit according to claim 14, wherein, with the exception of capacitors, all circuit elements of said protection circuit having low power losses are integrated on one chip.
28. The protection circuit according to claim 27, wherein, with the exception of capacitors, all parts of said protection circuit are integrated on said chip, including said load current switch, said short-circuit switch, and said fusible link.

Please add the following Abstract:

--ABSTRACT

The invention refers to a charge/discharge protection circuit for a rechargeable battery which is protected by a fusible link, where the rechargeable battery comprises a control logic which opens or closes a load switch depending on the magnitude of the battery voltage, the voltage on the charge/discharge terminals of the protection circuit and the charge/discharge current. The protection circuit is designed so that the electric strength needs to match only the actual maximum battery voltage, thus requiring little real estate on an IC chip and also allowing most components to be integrated.

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REMARKS

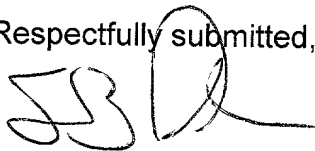
Claims 1-13 were canceled and claims 14-28 were added. In the specifications one paragraph starting on page 5, line 5 was deleted and three paragraphs were added in place of the deleted one paragraph. Also added was an Abstract.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned

"Version with markings to show changes made."

It is requested that should the Examiner not find that the Claims are now Allowable that he please call the undersigned attorney at (845) 452-5863, to overcome any problems preventing allowance.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'SBA', written over a circular stamp or mark.

Stephen B. Ackerman, Reg # 37,761

"Version with markings to show changes made."

In the Specification:

Please replace the paragraph beginning at page 5, line 5, and shown immediately below in square brackets, with the three paragraphs following the bracketed paragraph:

[Other implementations of the protection circuit are listed in claims 8 to 13. They relate to the function of the protection circuit in normal operation, i.e., the protection of the battery, respectively the current source, against over-load, deep cycle discharge and the exceeding of the maximally allowable charge or discharge current as well as the ability to integrate the protection circuit.]

In one preferred embodiment of the present invention a resistive means coupled between load current switch 3 and charge/discharge terminal 6, shown in Fig. 1 as resistor 4, acts as a current sensor to determine the magnitude of the charge or discharge current. In another preferred embodiment of the present invention the transmission resistance of the load-current switch 3 may be utilized as the current sensing resistance.

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Comparators D1, D2 of the control logic 10 are arranged to recognize a battery-side over- or under-voltage, respectively, and the comparator output signals trigger the opening of load switch 3 in the event of an over- or under-voltage.

With the exception of capacitors, at least all circuit elements of low power losses are integrated on one chip. In addition, but again excluding capacitors, all parts of the circuit can be integrated on the chip, including the load switch 3, the short-circuit switch 20, and the fusible link 2.

In the claims:

Claims 1 to 13 have been canceled.

Claims 14 to 28 have been added as follows:

14. A charge/discharge protection circuit for a rechargeable battery, comprising:

a short-circuit switch coupled in series with a fusible link across the terminals of a rechargeable battery, where one end of said fusible link is connected to one of said

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battery terminals, where said short-circuit switch when closed leads to the guaranteed destruction of said fusible link, thereby protecting said rechargeable battery from a dangerous current over-charge;

one end of a load current switch coupled to the junction of said fusible link and said short-circuit switch, the other end of said load current switch in communication with a first charge/discharge terminal of said protection circuit, said load current switch connecting or disconnecting said first charge/discharge terminal from said rechargeable battery;

a second charge/discharge terminal of said protection circuit coupled to the other end of said battery terminal; and

a control logic, coupled between said battery terminals and in communication with said first charge/discharge terminal, said control logic protecting said battery and said first and said second charge/discharge terminal from over-/under-voltage conditions, where said control logic opens or closes said load current switch depending on the magnitude of the battery voltage and the potential at said first and said second charge/discharge terminal of said protection circuit, said control logic comprising an over-voltage detector which closes said short-circuit switch when reaching a predetermined voltage limit, where said predetermined voltage limit depends on the electric strength of said protection circuit.

15. The protection circuit according to claim 14, wherein said over-voltage detector receives as supply voltage the potential via the opened load-current switch.
16. The protection circuit according to claim 15, wherein said over-voltage detector receives as supply voltage the difference between the potential at said first and said second charge/discharge terminal and the potential at said battery terminals.
17. The protection circuit according to claim 16, wherein, when said predetermined voltage limit is exceeded, said control logic closes the previously open load-current switch followed by the time-delayed closing of said short-circuit switch.
18. The protection circuit according to claim 17, wherein said control logic receives a first supply voltage from said battery and a second supply voltage from an auxiliary voltage source, such as a charged buffer capacitor.
19. The protection circuit according to claim 14, wherein said over-voltage detector comprises a bistable flip-flop.

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20. The protection circuit according to claim 19, wherein an output signal of said bistable flip-flop feeds a delay-element, said delay-element providing the control signal for the closing of said short-circuit switch.
21. The protection circuit according to claim 20, wherein said output signal of said bistable flip-flop via an inverter couples to the first input of an AND gate, where the output signal of said AND gate controls said load-current switch.
22. The protection circuit according to claim 14, wherein a resistive means in communication with said other end of said current-load switch and said first charge/discharge terminal acts as a current sensor to determine the magnitude of the charge or discharge current.
23. The protection circuit according to claim 14, wherein the transmission resistance of the said load-current switch is used as a current sensing resistance.
24. The protection circuit according to claim 14, wherein said control logic has a first and a second comparator (D1, D2), to recognize a battery-side over-/under-voltage, respectively.

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25. The protection circuit according to claim 24, wherein an output signal from each of said first and said second comparator triggers the opening of said load switch in the event of an over-/under-voltage, respectively.
26. The protection circuit according to claim 14, wherein a filter capacitor is coupled parallel to said charge/discharge terminals.
27. The protection circuit according to claim 14, wherein, with the exception of capacitors, all circuit elements of said protection circuit having low power losses are integrated on one chip.
28. The protection circuit according to claim 27, wherein, with the exception of capacitors, all parts of said protection circuit are integrated on said chip, including said load current switch, said short-circuit switch, and said fusible link.

Please add the following Abstract:

ABSTRACT

The invention refers to a charge/discharge protection circuit for a rechargeable battery which is protected by a fusible link, where the rechargeable battery comprises a

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control logic which opens or closes a load switch depending on the magnitude of the battery voltage, the voltage on the charge/discharge terminals of the protection circuit and the charge/discharge current. The protection circuit is designed so that the electric strength needs to match only the actual maximum battery voltage, thus requiring little real estate on an IC chip and also allowing most components to be integrated.

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